

AVIATION WEEK

A McGRAW-HILL PUBLICATION

NOVEMBER 29, 1948



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THE PRODUCTS shown on this page are typical of a wide range of power units manufactured by the Aircraft Accessories Division of our company as "Aero"®.

This division has specialized for years on the engineering and production of power units for aircraft, including fuel pumps, as well as compressor and precision devices of all types. Its fine designs and has won world-wide recognition for the production of the strongest compressor assemblies of metal, aluminum or magnesium used in aircraft supercharging, aircraft engines.

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But this is just a beginning. Look for still greater things to come from the new B. F. Goodrich Research Center, the world's most complete center of rubber research. B. F. Goodrich research works constantly to make flying ever better, cheaper, safer. For help with your problems, write to *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio*.

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This newest Jet Fighter for the U.S. Navy, developed for increasingly high performance, operates from either land or carrier decks. Stable aerodynamics and rugged construction permit unusually short take-offs and landings and accurate maneuvering advantages in the design of wings and control.

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Contractor to the Armed Services

THE AVIATION WEEK

Looking Ahead to 1960

By John K. Northrop
(President, Northrop Aircraft, Inc., Hawthorne, Calif.)

Predictions concerning the future of aviation are a dime a dozen. They vary widely and are worth little unless substantiated by some logical analysis. It is my opinion, however, that they may be safe in the mark. In 1958 a British aviation magazine invited a number of the foremost English engineers to write astronomical forecasts. A review of the predicted events furnishes an interesting comparison with the facts. It was then almost unanimously believed that large flying boats would be the universal long range air transport vehicle, yet today at least 95 percent of long range transport is by landplane, to which the critics hold no brief.

Almost all of the experts thought that military plane speeds could never exceed 600 mph, and that 200 to 250 was the all-time economic limit for passenger transports. Both categories have already exceeded these estimates by a wide margin. The individual who seemed to have the best insight into the future was most sanguine though it would be safe to say he had the boldest pronouncements. He believed that "certainly, regular supersonic commercial flights would be feasible," yet said nothing about regular supersonic service in the United States unless two years later. When you consider by how far surpass the most popular material for military airplanes, another thought 3000 hp, to be the all time maximum power that could be expected from aero-thermal engines.

The connoisseurs certainly track aviation as tightly as such predictions too seriously, and prove, if anything, that the best connoisseurs of aviation will be ultra-conservative, even in the high velocity business of aviation.

Here I am committed to an extension of aviation history to 1960, which I will undertake, leaving the short qualifications in mind. My opinion is based on over 35 years active participation in the history of aviation, but certainly do not represent any broad consensus of the ideas of aviation authorities.

Guided Missile Future

First, and most important, it is believed that jet-powered guided missiles will come into military use within two years and will form the main backbone of the Air Force's offensive and defense by 1960. Although several intermediate steps will be involved, two predominant types will hold the stage at that time. The first of these will be a long range winged missile propelled by variable power plants now in existence and capable of carrying large loads of TNT or any other destructive warhead. The interloper for this missile, operating at speeds of approximately 600 mph, is generally well and soon capable of extension to over 1000 mph before 1960. It will have sufficient range for launching from our coastal areas against any desired target in the northern hemisphere and will be recognized by merely radioactive fission having a higher degree of intensity than any now in use with unarmed strength.

Such missiles will largely, if not completely, supplant the long range bombers of the strategic air forces and all things considered, will deliver a pound of warhead at a lower cost to the country's economy than has ever been possible with unguided assault. They will have many advantages over present piloted planes, some of the principal ones being existential reliability, high accuracy, and negligible main finance costs. Their use will move the focus of military

power from the cockpit of a bomber to the industrial sites in the heart of combatant nations.

Interceptor Missiles

The second type of missile predicted for general use will be a ground-based interceptor which will almost completely replace unguided fighter aircraft. This missile will be much smaller than present fighters, will be solar powered, equipped with automatic devices for guidance to its objective, and will contribute the sole offensive defense against a mass attack from enemy long range missiles. The balance of power in the offensive-defensive conflict will depend on the efficiency of detecting approaches and the organization and coordination of defense forces operating the ground-to-air defensive missiles.

The offensive missile definitely will have the advantage. Some will be interceptors but not a large percentage in a coordinated anti-air attack. Tremendous value to the aggressor will be in the unexpected or unassisted offensive blow. It will require the development of fully automatic detection and defense systems to justify its employment to give a reasonable degree of security against surprise attacks.

Manned fighters and bombers will probably be limited to transport of various arms and cargoes. The transport will receive an assisted loan in the efficient conduct of any military operation and it is believed the military transport will in general be quite similar to its civilian counterpart in 1960, in its body.

Long Range Transports

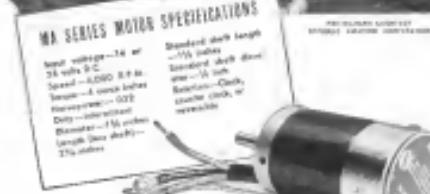
The long range transport for both civilian and military use is envisioned as the cleaned possible design. It will be a flying wing having a gross weight between 100,000 and 200,000 lbs and will have a direct operating cost of less than 5 cents per ton mile of payload. Because of the commanding need of fuel economy in its operations it will probably cruise at about 500 mph and be driven by gas turbine propeller power plants rather than turbines.

If our development of atomic power plants for aircraft is successfully realized, we will have large engines driven by nuclear energy in service well before 1960. They will have excellent range and very high speeds. Such ships will be enormous expensive and therefore comparatively few in number. Except for specialized services they will be limited to the guided missiles in their ability to deliver a payload to enemy territory at the lowest cost in our country's economy.

In the field of power plants large strides of improvement lie open before 1960. If the turbine is to be used effectively in long range transoceanic missiles, a large increase in thrust per square foot of frontal area must be achieved. Methods are available whereby this factor can be at least doubled over the best transonic power plants now in use in the country. Such improvements would apparently double the range of a long range guided missile flying at speeds of from 1200 to 1500 mph.

The cost of American industries must be kept pretty much in the hands of the diplomats. Science has for us reached her ability to control an destructive potential. The social attack can be all powerful and completely devastating in effect. Our great cities with their enormous industrial powers for good or evil may become our first line trenches long before 1960.

You've got to be GOOD
to fly in the new
THUNDERJETS!



**BENDIX 100 MOTORS POWER THE
TRIM-TAB ACTUATORS IN THE REPUBLIC F-84 "THUNDERJET"**

Manufacturers of the famous*, the complete, resourceful—Airborne Accessories Corporation, Hillside, N.J., claim that tiny Bendix name for small size, light weight, power and dependability.

This is but one of the new MA Series of Bendix Motors designed for many aircraft—steer-by-wire actuators, fail-safe actuators, hand-change switching as radio equipment, anti-wracking devices—in short, for dozens of aircraft applications requiring small D.C. motors. Read the specifications above—then write today to our engineering department for its recommendations.

*Patented by Bendix Corporation

BENDIX DIVISION
OF WILCO AIRCRAFT CORPORATION
Red Bank Division
Red Bank, N.J.

AVIATION CALENDAR

See Box 4—American Society of Mechanical Engineers annual meeting Hotel Pennsylvania, New York City

Dec. 10—Aircraft Industries Assoc. Air Force Army Industry (AFAI) meeting on advances in military aircraft Washington, D.C.

Dec. 1—Meeting on aircraft use and maintenance sponsored by the American Society of Mechanical Engineers, McGraw-Hill Building, New York, N.Y.

Dec. 6—Annual meeting of the Society for Experimental Stress Analysis, Hotel Commodore, New York City

Dec. 6—International Conference on International Civil Aviation, New York City

Dec. 6—Starting on December, sponsored by Magnetic Area and Motion Systems, Motor Institute, Pittsburgh, Pennsylvania

Dec. 6—American Motorcar Society—Sales, service and preparation of antique automobiles, Hotel New Yorker, New York City

Dec. 14—Aircraft Industries Assoc. Air Force-Army-Industry meeting on aircraft use requirements, Power Plant Lab, Wright-Patterson Air Force Base, Dayton, Ohio

Dec. 18—Annual World Business Seminar, Institute of the Aerospace Sciences, 1200 Avenue of the Americas, New York City

Jan. 8-10—Florida Flying Academy Club, 34th annual session, Melbourne, Fla.

Jan. 18-20—Society of Automotive Engineers, Aircraft Marine and Engineering Division, Hotel Marlin Carmel, Carmel, Indiana

Feb. 10-11—HCAO Communications Division, Mountain View, Calif.

Feb. 10-11—Commercial Space Operations conference, University of Illinois Urbana, Ill.

Feb. 18-19—Fourth SAIL Control Meeting, ASA, office independent staff

Feb. 18-19—Third Air Transport Association Annual Meeting, Washington, D.C.

Feb. 26-March 1—House Naval Affairs, Institute of the Aerospace Sciences, Hotel Astor, New York City

Dec. 10-11—IAS annual annual meeting, Hotel Astor, New York City

Dec. 15—Society of Automotive Engineers, aircraft marine and engineering division meeting, Hotel Marlin Carmel, Carmel, Indiana

Feb. 8—HCAO Operations Division, Mountain View

Feb. 10—HCAO Administration Division, Mountain View

Mar. 8—Society of Automotive Engineers, aircraft marine and engineering division meeting, Hotel Marlin Carmel, Carmel, Indiana

April 10—First Annual Southern Chapter, International Air Race Team, French

PICTURE CREDITS

Walt World, 12, IN Photos, 13, 16,
U.S. Navy, 24, Sabre, 35

You
can't
keep
good
plane
down!



Here's the Piper 4-place Family Cruiser—and right *is the* Senenich Skyblade. It's the right combination!

With plenty of "power" and plenty of "gulf", it's caring to go up in the wide blue yonder with a new flying thrill in store for America's personal pilots.

Piper engineers chose Senenich because time and tests have proved that Senenich engineers know their business, too! They've been designing and building light aircraft propellers exclusively for more than a quarter of a century.

That's why Senenich propellers—fixed and adjustable—are right for your ship. Chances are you have one now (most planes of 250 HP or less, do!). But if not, it's time to see your dealer and find a new thrill in flying—really top performance with a Senenich right *is the* issue!

PROP-SHOP. All makes (wood) re-sawed promptly at main plant or West Coast Branch. Send these to Senenich

SENENICH CORPORATION

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ANNOUNCING THE NEW Turbo-Cyclone 18 COMPOUND ENGINE

longer range, increased payload, greater economy and higher power output are provided by the lower weight **Reinforced Composite development.**

The Turbo-Cyclone 18 combines the repeatable performance of the super-roating engines with the simplicity and compactness of the gas turbine. It utilizes a sizable portion of the energy in the exhaust gases of a reciprocating engine to drive three turbines that are geared back to the engine crankshaft.

To the operator the Turbo-Cyclone 18 offers a choice of (1) a reduction in specific fuel consumption of as much as 20% or (2) a 20% increase in range on the same amount of fuel, or a combination.

that increase in payload because of the reduced fuel consumption, or (3) a 20% increase in power for the same amount of fuel. Additional bonuses include:

- Lower specific weight—less than one pound per horsepower developed
- ease of installation in existing aircraft—fit within cowling lines of existing nacelle
- ease of maintenance—no additional cylinders, readily removable turbine units, ease of operation
- no additional controls...no specialized training of flight crews

The production of the Turbo-Cyclone 18 fulfills today's requirements for optimum economy and performance in long range aircraft.

Another example of Wright engineering leadership in developing new principles for the aviation industry.

POWER FOR AIR PROGRESS

A Division of the **Wright Aeronautical Corporation**
Wood-Ridge, New Jersey



WRIGHT

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INDUSTRY OBSERVER

► McDonnell has solved the formerly vexing problem of starting the six jet engines on its experimental helicopter, "Little Henry." Formerly the blades were whirled to starting speed by an electric motor driven crank. McDonnell used a compressed air hose to provide initial compression for its own jet helicopter. Now McDonnell has worked out a system of whirling the blades by hand that will allow the new jets to be started.

► Protection, Inc., of Los Angeles has received orders for approximately 350 of its Tropics dual-jet aircraft liaison fleet for pilot observers. When Oct. 41 Navy wanted 100 for service testing, Congress ordered 15 to equip its test pilots and the answer served of the army field forces will less than 100 on personnel at high speed tasks.

► At Convair, North American test pilot, codifies the Tropic incident with using his life during dive tests of a North American F-100 (FJ-1) at Patuxent River, Md. The canopy came off during a dive, and, as corrosion with the bubble type canopy used as well as fighters attempted to snap out the cockpit as it took less. Convair suffered a concussion that knocked him unconscious. He did not fully recover consciousness until after he landed the damaged plane. Analysis of factors taken by the laboratory's hunched glass floor after takeoff showed that Convair would have been decapitated without the helmet.

► Chance-Vought division of United Aircraft will continue building short term for the F-104 Starfighter at its Stratford, Conn. plant and next year although production possibly low for the plane will be set up in the new Dallas plant. Production of F-105 Thunderchief will end at Stratford and will continue for the Navy at Dallas. Pufate production is expected to begin next Spring at Dallas.

► Air Force is using Bausch high intensity runway lights, manufactured by Loral Material Co., to both the Tanglewood and Rhein-Main Airports on the Berlin wall. The high intensity runway lights combined with high intensity approach lights and noise are expected to materially aid night operations during the winter bad weather season.

► Although Floyd Odlum was still suffering with Reconstruction Finance Corp. and private financial interests had won for financing the Convair Equipment Corp., Consolidated Vultee Aircraft Corp. apparently has no doubt of the eventual establishment of the plane-leasing subsidiary. Convair already is talking for bids from suppliers for the 300 Convair 88s "we are forming the Convair Equipment Corp."

► Navy will shortly put its five double-decker Lockheed Constitution intercontinental aircraft in the Military Air Transport Service on a super "hotline" service to replace the C-141 in the Berlin airlift last summer. The Constitution can carry 138 passengers or 30,000 lbs of cargo on the Washington-San Francisco route and incurs three round trips a week. Powered by four Pratt & Whitney Wasp Majors, the Constitution cruises at 520 mph.

► Prototyp Sud Stanavia transport is scheduled to go into cargo service with SAS/ABA next month. Prototyp has completed 452 hr in the air including a 17,200 kilometer tour of Europe. Prototyp will sell for about \$19,000 and SAS/ABA has ordered 10 passenger variants which it expects to get by the number of 1949.

► The Australian cabinet has decided to cancel production plans for the Tudor II transport. Decision was made because of unfavorable price factors of the aircraft which already resulted in a test field in England. The Commonwealth Aircraft Corp. spent about \$400,000 on tooling and other preparations. It is likely that British frontiers will be built in place of the Tudor II. Meanwhile, the CAC is proceeding with its program of 75 Lancasterns, 38 of which have yet to be delivered.

► Trans-Canada Airlines has ordered an unspecified number of Avro YC-107 four jet transports for service as transcontinental aircraft according to A. V. Roe Ltd. of Toronto. This is the first airline order for the Canadian-built jet transport which is scheduled to be test flown next February at Toronto.

NEWS DIGEST

DOMESTIC

Ralph V. Hart resigned in late past decade controller and director of Douglas Aircraft Co. He had been with Douglas since 1940. He has now an independent consulting firm.

Mather M. Cooper will leave the Glenn L. Martin Co. Dec. 31 to join another company. At Martin he has been vice president, personnel and public relations, and a director.

Consolidated Vultee-Northrop merger definitely is off, and Northrop has so informed Floyd Odlum, Convair board chairman. Northrop officials tell AVW that Convair thinks it is not acceptable in its present form.

FINANCIAL

United Aircraft Corp. reports net income of \$75,562,270 for nine months ending Sept. 30 on sales of \$157,276,707. For third quarter ending Sept. 30, net income was \$1,815,639 on sales of \$46,801,065. Consists, sales and letter of intent of aircraft at Sept. 30 amounted to about \$775 million.

Lockheed Aerospace Corp. declared its third \$2.00 cent dividend of the year, payable Dec. 20 to stockholders of record Dec. 1.

McDonnell Douglas Co. reports net profit of \$62,678 for last quarter, ending Oct. 30 on sales of \$17,377,271. Backlog entry as Nov. 30 was estimated to about \$4,890,000.

Beech Aircraft Corp. reports net income of \$2,210,325 on sales of \$24,411,120 for the fiscal year ended Sept. 30. The previous year, Inc. of \$10,834,493 was taken on sales of \$26,211,471.

FOREIGN

International Scheduled Airlines have begun a study of instant class cabin linings toward initiation of world wide Airways service by the fall of 1969. It was disclosed last week by W. J. G. D. Beeson, chairman of the joint ruling committee of the International Air Transport Association, which just concluded a meeting at Bermuda.

Australian National Airways has bought 49 percent of the stock of the Division of Cyclone's national airline, Air Ceylon. Air Ceylon will be operated under ANA's supervision for at least ten years, after which the government may want her back. ANA's share at market value.

British Overseas Airways Corp. is trying to obtain the concession to operate the Indian military airport at Tocantins, while KLM Royal Dutch Airlines already has obtained the concession for the Italian airport of Bressana.

HEADLINE NEWS



Chase Tests New Cargo Plane

TRENTON—The successful first flight of the prototype, new YC-122 Air Force small transport possibly could catapult comparatively small Chase Aircraft Co. into a leading position in a marketplace of cargo planes.

Actually a Chase CG-18A glider with two B-2000 engines, the prototype used cargo plane at the company's first test flight in powered aircraft. Since 1946 Chase has been building experimental aircraft, principally for the U.S. Army. It also has contracts for several CG-18As, the larger CG-20, and the CG-113 (powered version) of the CG-20. Present contract for the CG-122 covers two planes. The prototype begins its Air Force work will be the springboard for later commercial business.

After two hours of test flying over Morristown Airport here, E. J. Clinton pilot, and W. F. Sauer, Chase executive engineer who acted as co-pilot, rated the performance as all that could be desired. According to Sauer, at 5000 ft indicated cruise was 195 mph at 2000 rpm and 34 in. kg. "We stalled at 10 m indicated speed of 68 mph. Initial rate of climb was 2000 fpm."

► **Loading Ease**—From the flight spectators witnessed a smooth loading and unloading operation which defied the reputation of the CG-122 as being a "logistically complex" aircraft. Using a truck loader, the tail section of the craft. A 14-in. Army track drove onto the plane as much the same manner as it would enter an ordinary garage. In another operation, the plane on loaded 34 fully equipped troops in a matter of seconds. They came and they stayed.

The CG-122 is aimed at operations on rugged terrain which requires short take-offs and landings. Its prospective use will be the transport of medical and engineering equipment for

airborne assault troops, particularly into suspended fields in forward combat areas. It can also be used for evacuation of wounded and to carry paratroops.

Power is supplied by two Pratt &

Whitney 2000-cu-in rated at 1500 hp each, turning 12.5-blade Curtiss Electric reversible propellers.

Other specifications.

Length	16 ft. D. T. 24
Cabin dimensions	7 ft. 6 in. x 4 ft. 6 in.
Wings	71 ft. 6 in.
Height	4 ft. 6 in.
Wing area	140 sq. ft.
Empty weight	12,000 lb.
Take-off weight to altitude 10,000 ft. with 100% power and no load	18,000 lb.
Length of climb to 10,000 ft. with 100% power and no load	10 min. 45 sec.
Ranges with maximum range	1000 miles
Max. speed at 10,000 ft. with 100% power	195 mph
1000 ft. climb	1000 ft.

Slope Line System Favored for Funds

A move is under way to speed funds allocated for high intensity lighting equipment at final, 1949, for the Civil Aeronautics Administration slope line system. This means making a change in the recommended approach lighting standard set last year.

This proposal was approved early in November by the Airport Lighting Evaluation Panel at a meeting at Lord Adair Experimental Station, Azusa, Calif. It will be submitted for final approval to the Air Force-Navy-Civil Sub-commission of the Minimum Board of aviation ground and seafarers visual aids. It is this subcommittee that makes the approach light standards.

► **CAA Funds**—CAA has funds to buy 10 sets of high intensity lights in fiscal 1949. Each for this purpose was scheduled to be opened in mid-November but may be postponed until the ANC subcommittee has a chance to act on the new proposal.

Last year CAA purchased two sets of AGA high intensity approach lights in conformity with the ABC standard set last year. This calls for a double row of lights extending 3000 ft. from each side of the runway with the left row red and the right one yellow. Only the left row was to be installed at civil fields. The slope line system consists of 10 sealed beam aircraft landing lights mounted on a base set in an angle of 45° to the ground pointing toward the extended centerline of the runway. These are either made of the economy extension reflector to provide a visual glide path as well as a directional alignment with the runway. The lights are standard aircraft landing lights manufactured by General Electric Co.

► **Want More Tests**—The ALEP proposed that no change in the present red and yellow panel standard be made but you had that the slope line system be modified at airports for further operational testing. Experiments at Akron during the first half of the current budget indicated that the blue line configuration was the most effective from approach lighting.

A special group of pilots, meeting at Akron to determine the effectiveness of test lighting, found the blue panel standard to the LAES standard. The panel standard is 45°-45°-45° (Aviation Week, Oct. 25). The pilots group agreed that the Bureau F and D systems were not suitable below runways of 200 ft. ending and half mile visibility when using entirely as lights over landing field or in contact flying conditions. AGA double row systems and Seligson ladder systems were considered good down to zero ceiling and 6-mile visibility. Slope line systems were considered suitable down to zero ceiling and 6-mile visibility.

► **Want Fixes**—The ALEP also agreed that the identification features of the Bureau and Westinghouse systems provide the best identification characteristics and that a similar system should be adopted. An alternative approach recommendation is already up and set for year.

Bugay said at the slope line system according to the pilots opinion is the intensity of the lights rather than the visual glide path if properly provided. As a result further tests will be made with the 10 lamp lighting units of the slope line system without their angular distribution. Other recommendations included concentration of light near the end of the runway to provide more positive identification of the runway threshold.

Business to Canada Brings U. S. Comment

Expenditure of USAF money for aircraft parts obtained from Canada is provoking complaint among some American manufacturers that their Canadian partners could treat them harshly discriminating.

The situation is to a situation which enables the growing Canadian aircraft industry to use the low Canadian labor rates to an advantage in bidding for contracts in the civil market, while the American competitors are accustomed to higher wages by wage and benefit law and overtime pay rates.

► **Varied Methods**—Only a portion of the USAF parts liaison obtained by Canadian plants appears in direct competition with American companies buying USAF parts who have no influence or strength on military awards and who begin to compete with Canadian firms.

Principal Canadian industry is reported to be Canadian, Ltd., at Montreal. Representatives of Canadian 40 frequent visitors at Air Materiel Command headquarters, Wright Field, is much of Air Force business. Within the last few weeks Canadian is reported to have received the latest in a series of parts contracts for approximately \$500,000 worth of G-47 parts to use in military planes.

► **C-47 Parts**—Canadian obtained a large stock of G-47 parts and tooling just brought in surplus from the Ordnance City Douglas C-47 plant when that was closed at war's end. The Canadian company has sole long-term permission at the Douglas plant of the Chicago Douglas C-47 plant.

Efforts of the Canadian company to sell all aircraft maintenance contract to the USAF in overhead U.S. military planes is Canada set with violent protests from large American aircraft union members, operators and from U.S. labor groups who protested the labor rate differential. The result was "no bid" for the Canadian firm on the major maintenance contracts.

► **Labor Differential**—Original manufacture of the planes for which Canadian is supplying parts, Douglas Aircraft Co. is the American manufacturer principally affected in the annual parts contracts.

An analysis of the labor cost differential situation indicates two alternative solutions. Either USAF takes some action in its contracting relationships which will eliminate the competitive edge of American manufacturers will probably seek to establish plants in the other countries which have the lower labor rates.

Douglas' 1947 financial reports shows the company made approximately one quarter of its consolidated income from

parts contracts which netted a total of more than \$24,300,000.

Kitty Hawk in Museum

A long Navy crack handoff up front of the Smithsonian Institution in Washington last week, to deliver the Wright Brothers 1903 Kitty Hawk plane, 541st plane to be packed in the plane was packed in three crates and will be assembled for exhibition in the first floor of house at the National Museum at Washington after its 45th anniversary of the first flight.

A Const. Guard helicopter, symbolizing the aid of the Kitty Hawk, N.C. Coast Guard station in the Wright Brothers and Air Force, Navy and Army bands, participated in a brief ceremony when the plane was secured by Smithsonian officials.

It had come to Washington from Brooklyn where the trip had started a three-day flight. The craft had brought it from Wichita, Kans., where it had been held by the Manufacture after its route from London.

Wright Field Pioneer Dies

Ring Com. William N. Gilman, former assistant chief of the Air Corps in charge of procurement who directed the establishment of Wright Field, Dayton, Ohio, died recently at Walter Reed Hospital in Washington at the age of 71. After retirement in 1936, Com. Gilman went to China to serve as active duty in World War II. He was retired to civilian service after the new research plant is ready.



WORLD'S MOST POWERFUL TURBOPROP

First flight of Pratt & Whitney's Turbo-Compound R-3350, the world's most powerful aircraft engine, was made on Nov. 12. The engine is a 20-cylinder, 2000-hp, air-cooled radial. Developed under Air Force contract, the new engine is far too powerful to power jet aircraft in its original form. It will be used until a flying test bed can be developed, possibly the nose of a Boeing B-39 bomber.

assault consultant to Douglas Manufacturing Co., Detroit, who had large aircraft component contracts and in recent official communication said he was at work on a new project.

Com. Gilman directed initial construction and later expansion of facilities at the Wright Field Air Corps Test and Development Center, and supervised transfer of activities from the earlier center at old McCook Field. He was graduated from U.S. Military Academy in 1908, transferred to the Army Air Service in 1917, and was his pilot's rating in 1920.

A son, Ring Com. William N. Gilman, artillery commander in the 11th Airborne division, flew from the Japanese retreat to Washington for the funeral.

New Laboratory Site

Airborne Instrument Laboratory will build an all-new \$23,000 research laboratory at Pleasanton, Long Island, once miles east of the present ALI plant at Mineola. Production of a 75-ton test bay will be completed next week. Zoning clearance for already been obtained.

The new research layout will bone at least five buildings including a two-story brick administration building and a number of small research buildings. Clearing of the land will start as soon as the purchase transaction is completed, and construction will follow. Current plant manufacturing process ALI will continue at the present Mineola location, which will be retained by the new research plant is ready.

ENGINEERING



INSIDE: Avco's indicate one location of standard radio equipment on this XTC C-54 flying lab to permit internal antenna-1, glide path locator, 2, beam set antenna 3, marker beacon receiver and 4, radio compass loop and VHF command and bearing antennas.

Drag Cut With Plastic Antenna Housings

Internal systems meet speed challenge, but interference is bitch.

By Robert McLoone

The attributable reduction in aircraft drag in the past twenty years has made possible aircraft speed increases that have produced the 380 mph subsonic fighter and the 600 mph fighter.

Throughout the power increases, radio antenna and receiver locations have moved progressively on aircraft, particularly transport planes carrying an increasingly large variety of radio equipment. Accordingly, this equipment increased and became more complex during these years.

How DC-3 Was Fitted—Typical power Douglas DC-3 planes were equipped with (1) tailhook antenna from cockpit to top of fin for intermediate frequency two-way communications, (2) short air band antenna from top of fin to big gage compartment for emergency radio range receiver, (3) two vertical whip antennas below cockpit to wireless radio range and traffic control simultaneously, (4) expandable loop for mobile free radio range reception at bad weather, (5) omni



loop for automatic direction finding equipment, (6) two sense antennas on short, thin arms below fuselage to provide automatic orientation for the two direction finders, (7) short, but small T antenna below fuselage to receive VHF marker signals, (8) horizontal loop antenna for instrument landing reception, and (9) one or more VHF antennas, depending on equipment carried.

These arrays are extended to keep cut at least at 20 nautical miles; the cutting speed of the DC-3 of that period

► Short Antennas—One factor that entered in aircraft drag was the steady drift in aircraft radio frequencies from the minimum in the high and very high bands with accompanying reductions in antenna length. Very high and ultra high frequencies normally require antennas only a few inches long.

This trend made it apparent early in the war that such short antennas might be fully enclosed within the aircraft metal skin, provided the problem of interference could be solved.

One of the first radio units to be

installed outside aircraft Wind Model 524 A. Later versions manufactured by Stewart-Warner Corporation to built with U.S.S. Stainless Steel.

FOR IMPORTANT PARTS LIKE THESE

*-it
pays to use
U-S-S
Stainless!*

Stainless exhaust nozzles like one of the ones shown above are used on Pratt & Whitney J57 engines. Photo by U.S.S. Steel.

These manufacturers, well-known in the aircraft industry—Ryan, Solar and Stewart-Warner—are represented in the products shown here. All use U.S.S. Stainless Steel because it has *perfected*, *superior* steel—steel they are assured a consistent durability of composition, finish and fabricating qualities that allows them to employ the most advanced manufacturing techniques.

U.S.S. Stainless Steel admirably meets the stringent requirements for aircraft and engine parts that must have not only high resistance to corrosion, oxidation and cavitation but must maintain these properties at extremely high temperatures for many hours at a stretch. It lends itself readily to intricate forming, to gas, arc and resistance welding and other fabricating processes.

To help you apply U.S.S. Stainless Steel to more optimum results both in its fabrication and in its performance, we offer you the practical cooperation of our engineers. They will gladly show you how to realize the full advantage from its use.



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NATIONAL TUBE COMPANY, Pittsburgh • TENNESSEE COAL, IRON & SALTWORKS COMPANY, Birmingham
UNITED STATES STEEL SUPPLY COMPANY, Washington Headquarters—Send to nearest UNITED STATES STEEL EXPORT COMPANY, New York

fully enclosed was the direction finder loop antenna, which was put in a housing in the early '50s principally to provide an electronic shielding assembly to protect the loop from the static charge on dirt, rain, snow, etc.

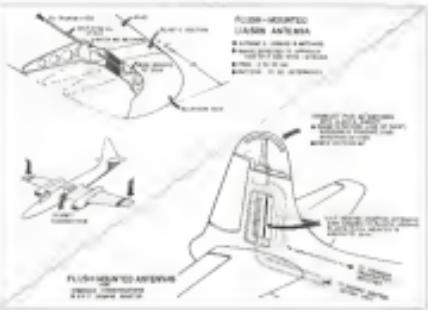
However, this housing was modified in a streamlined form to cut the drag, which was reduced as much as 60 per cent in some cases.

► **Radar Research**—Introduction of radar into the war brought the problem of placing the early ASV dish antenna and its non-conducting associated equipment and feeders in the subsequent aircraft without having to compromise the airframe performance.

For more than five years this has comprised a joint research program of the Air Materiel Command, Naval Air Development Station, Massachusetts Institute of Technology's laboratory, Infrared and Microwave Industrial Research and Development Contractors.

How well this program has succeeded is evidenced by the fully enclosed airframe installations in these units—Lockheed F-94, Republic F-84, North American F-86, Convair XJ-37, McDonnell F3H, Northrop NF-94 and the special Douglas C-144 handled by Goodyear Aircraft Corp., with no enclosed antenna sections reported.

These aircraft feature installations of instrument approach and radio compass



antennas within the canopies and radio altimeters, radio beacons and search radar antennas within the fuselage.

► **Dilemmas Involved**—Principal problem of the plane antenna designer is the elimination of undesirable reflection and scattering.

The breaking of heat-shield apparently accounts of reflected power and introduces distortion of the radiated

field through reflection, reflection diffraction and other difficulties comparable to those of light passing through windows.

At worst, the housing can reflect sufficient energy back into the antenna to cause signal instability on the equipment.

The conflict between reflection and aerodynamic drag is not an easy one to

solve since research has revealed that these are critical incidence angle limitations below which the enclosure will reflect radiation back into the antenna. Here, the designer cannot be sure how far beyond the limitations of these critical angles.

It is this basic conflict that has created the complex design problems in the antenna enclosure field.

► **Thickness Factor**—When the shift from medium to very high frequencies has aided the shrinking of exposed antennas, it has worked in reverse in the older, full-scale designs.

In the former, the wave lengths are so long that the thickness of the enclosure is a negligible small fraction thereof and very little reflection difficulty exists.

With the extension of radar into the microwaves field, in which the wave length is only a few millimeters, thickness of the antenna enclosure becomes a very appreciable fraction of the radiated wave length. Reflected energy from the outer and inner faces of the enclosure are no longer in proper phase relationship to cause microwave reflections of the incident energy.

In addition, the principle advantage of microwaves is their ability to penetrate the protective caps and sealing surfaces of the canopies and protruding points determine the critical incidence angle previously mentioned. Up to

► **Design Approach**—One of the solutions to this problem is the use of low pressure laminates formed into a sandwich of two thin glass separated and fully stabilized by a controlled thickness of low density core, usually foamed aluminum. This strengthens the overall construction of enclosed antennas and simultaneously provides a great increase in strength for a given weight over that resulting in angular designs.

It is this high strength characteristic that makes the sandwich-type enclosure promising for low-cost and improved designs.

Solutions of the major problems in the design and fabrication of antenna enclosures are:

• **Provision of adequate structuring.**
Achievement of sufficient electrical transmission efficiency.

• **Limitation of heat distortion and distortion to enable tolerances.**

Development of strong, lightweight materials, also suitable for elevated temperatures.

• **Reduction of undesirable resonance,** particularly when subjected to sun and heat erosion.

► **Structural Design**—The relative orientation of the protective caps and the sealing surfaces of the canopies and protruding points determine the critical incidence angle previously mentioned. Up to

leading values to which the angle of incidence may be extended in a relation of the dielectric properties at the wave path, and the lower the value, or the distance constant the greater the allowed angle of incidence.

Full relationship pointed towards proper alignment of the enclosure thickness as a solution to the problem. Subsequent experiments proved the desirability of providing a variable gradient of the enclosure wall thickness to suit the incidence angle conditions encountered throughout the enclosure.

Variations in wall thickness now become possible in design calculations which facilitate the development of safe and reliable enclosures.

► **Transmission Efficiency**—It appears that an accurate analysis of air resistance, resistivity is needed, the extent of the analysis required varying directly with the degree of enclosure streamlining desired.

Methods have been developed for conducting complete analysis of an airfoil configuration with a considerable degree of accuracy. These studies provide all needed data on the incidence angles and relative polarization directions encountered throughout the enclosure, thereby providing design information for proper grading of wall thickness. However, the designer can take account (Continued on page 24)

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Without engine in background for the comparison, this view of full-size XPST-1 looks like model-experimental tool for advance testing—just as strongly realistic appearance of Consolidated-Vultee Aircraft Corp's new XPST-1.

How Flying Boat Scale Models Pre-Prove Design

A precision pre-test program utilizing a radio-controlled, 1/10 scale model has facilitated Consolidated-Vultee Aircraft Corp. with valuable information on how its new experimental flying boat, the XPST-1, will perform—both as the water and in the air.

This type of advance proving is intended to insure elimination of surprises and hazardous difficulties which might seriously be encountered with trials of an actual aircraft.

► **Scale Details**—Except for leading edge wing slats, which were necessary to give full scale XPST characteristics, the model is a genuine duplicate of the full size craft. In addition, weight, performance,

and dynamic forces acting on the model are also to scale.

The accompanying photos show models in which the technique has been applied—the XPST-1, XPST-1 (full scale craft was built) and a model which represents no specific flying boat. Also perhaps is a method of rigging a model for an aerodynamic test setup.

► **Model Motions**—Model wing and hull motions both encourage confidence, indicating a higher strength margin than in the full size plane. Added weight owing to inherent weight of hydrodynamic drag is the main factor.

Wind factors are factored, conventional rudder direction,

adjustable pitch propellers are set chord from 21ST chord.

Weight of the assembled model is 90 lb. Radio control system weighs 20 lb.

Propeller installation compensates for 2 hp engine.

► **Radio Action**—Radio controls can handle the model up to distances of 1000 ft. Engine throttles can be controlled by radio or shut off completely.

If the craft assumes an unfavorable attitude, controls automatically react to a predetermined position when the model is in contact.

Should the model fly beyond the range of the transmitter, the signals



Convair's radio controlled miniatures afford data disclosing how actual craft will behave.

stop contact with the water.

Convair is instrumental with these radio-controlled tools in speeded up work to permit flight records of takeoff and landing.

► **Aerodynamic Tests**—For measuring aerodynamic forces, an automobile is rigged with a detachable bar supporting a radio cage, with a model mounted on a pole fixed in the cage. Sensors gauge on the axle measure forces on the model.

Simultaneous readings of the gauges and a sensitive live-speed amperemeter provide data for computation of aerodynamic data to be compared readily.

Compliance with wind tunnel results disclosed good agreement of lift, drag and control effectiveness.

► **Research Potential**—Convair has also constructed models without engines, launched them from a catapult to obtain data on landing characteristics.

In addition to stability criteria, Convair's technique is adaptable to all phases of hydrodynamic research—on hydrofoils, hull forms, auxiliary structures and high lift devices.

Flow testing flying boats can also be determined quickly.

And since from conception of an original design to its production stage can be effectively reduced.



Model engine, a model of XPST-1 is tested for catapult launching.



Scale version of XPST-1 is prepared for tests.



This flying boat model is ruggedized into the aerodynamic testing.

Antenna

(Cont'd from p. 21) long of the means of achieving efficient, highly directional antenna systems, subject to the extent of his knowledge in information telecommunication. Transmissions of the signals, the antenna depends largely on the device to which the transceiver can attach, to obtain the required surfaces and dimensional control.

Power Distribution—Importance of holding basic tolerances. As critical limits varies directly with the frequency applied to the antenna to be enclosed.

Generally, these limits fall into three general classes—loop-ups through VHF and ordinary range radio, shield noise, and RF control and heating coils. In this last class, the importance is imperative to otherwise unpredictable shield variations in reflection from the radome, resulting in extreme losses due to heating effects.

Locally, the thinnest possible metal-weld skin permitted by structural considerations after the heat points choice to reduce the captured degree

of reflection control. In addition, all possible overlaps and discontinuities must be eliminated.

Electrical Tolerances—In missile applications, antenna loadings should be capable of operation at extremely high temperatures because of their fast rate of heating effect on the system.

In piloted aircraft, antenna loadings

should be limited to the maximum temperature to be capable of operation up to approximately 70 °F.

Service Problems—Some antenna claimants are an external part of the enclosure and usually located over the region of maximum load by the elements, resistance of insulated plastic to the erosive effects of high speed flight is a major consideration.

Conducibility difficulty has been experienced in the past with this problem and the solution apparently lies only in continued development of higher strength bonding materials. Other service problems include development of non-deteriorating materials and methods for integral pigmentation of the enclos-

ure surface to match the airplane skin, very thin, slightly conductive, rather flexible which may be used to down off static charge without impacting the insulation performance, stability and, as far as possible, techniques, and methods and equipment for added protection.

Other improvements sought include adaptability of mismatch core materials to fabrication in guided projectiles, non-fatigue of physical and electrical properties, lower density, compatibility with insulating resins, resistance to impact shock, and adaptability for dimensions to close tolerances.

and susceptible at least 4-in. bullet-proof glass.

As an addition, explosive hatches should be considered—about 1 ft. in area for each 25 sq. ft. of seat area.

Large areas which should not be closer than twice as low should not be closer than two feet apart. If seat cell walls to avoid turbulence, should be located high enough from the floor to prevent entry of dust, and sustained to keep out prop. gas or other objects.

Cell Test—Provisions—While cells are provided with doors, locks should be used at entries so that either that ignition and starting power cannot be applied until the locks are closed.

General precautions to be observed in cell testing include: Prevent check of engine for long fitting, pre-start masking of engine to starting speed with ignition off to check fuel and oil leak, cutting of spark plug and unusual noise, closing of personnel from heat cell before start; starting of engine and riding the floor to observe heat accelerating and holding the top gear for not more than 5 min.; running the adjustable tail pipe temperature to maximum safe temperature, release of tail pipe assembly, and have crew enter cell for adjustment; and then start engine again.

Pin Ground Test—In an aircraft ground test, observe these general procedures:

The seat adjacent to the companion and without assistance, weighing a 15-lb. angle either side of the place of these seats, concrete walls should be 2 ft. thick, steel walls at least 5 in.

Outer windows should be held in these areas, but if required should not be larger than 6 in. wide by 2 ft. long.

Flight crews must be worn at all times engine is running.



How new a person can safely approach a jet aircraft under fire has been the subject of Navy experiments at Patuxent River, Md., where Lt. A. L. Hill, shown above, approached within two feet of the North American FJ-1 without being killed in the process.

the potential drift.

Quinton has had no instance of explosion ever since a machine was fired a year ago at Marine Corps, Calif., when he was sacked into smoke. Hill reported that at a little more than two feet distant the air velocity was about 18 times

Turbojet Safety Rules Emphasized

Introduction of the turbojet engine into the aircraft field has brought with it new problems of safety for test and service personnel.

Some of these new rules were outlined by Richard Wilson, who, as test engineer, North American Aviation, Inc., is a paper presented at the 30th National Congress, Chicago.

Cell Details—High engine speeds and abnormal operating conditions can cause jet engine static testing regres-

sively designed test cell buildings with 1-ft-thick concrete walls as 3-in.-thick barrier to shock damage caused by engine structural failure.

In areas adjacent to the companion and without assistance, weighing a 15-lb. angle either side of the place of these seats, concrete walls should be 2 ft. thick, steel walls at least 5 in.

Outer windows should be held in these areas, but if required should not be larger than 6 in. wide by 2 ft. long.

Flight crews must be worn at all times engine is running.

NEW AVIATION PRODUCTS



by Industrial Design Laboratories, 1212 W. 58th St., Chicago, Ill. Other design advantages are stated to include good seal in any position, package weight of less than 0.15 lb./in./sq. in., low retarding torque requirement of less than 268 lb.-in., long life because of no shifting forces, and double-duty service effect in modulus to control air flow or as shot-off valve. Unit has pressure range from 0 to 140 psi, gauge, and temperature range range of -65 to 500 °F. Electric actuator conforms to AN-M-10 open feature. Power consumption is 51 amp at 24.25 volt d.c. Time from closed to open position is 28 to 35 sec. Port diameter is 3 in. Weight of device is 140 lb.



Airport Guardian

New for track dredged and built by **Aerial Cleaning Co.**, Marietta, Ga., uses dry cleaned in primary cleaning stage. Capacity is 2380 cu. yds. per hour. Weight is 150 cu. yds. of material, 150 gal. of water. Fully loaded, vehicle weighs 21,000 lb., has four-wheel drive, five forward speeds and one reverse. Maximum governed speed is 62 mph, but governed can be removed for higher speed. Four sets of compartments on side have auxiliary fan and reverse equipment.



Hermetic-Seal Terminals

Sold terminals for use on orbital electronics—transistor, condenser and 16-way over, etc., is made of plated steel die-cast set in neck under rough handling and to be immune to thermal shock. Threaded surface, permanently bonded to stainless steel, provides easy soldering to enclosure after insertion in proper hole. Leads are brought through opening, twisted tightly through bushing and soldered to threaded pin provided at end of bushing. Made by **Gen. Connect & Sealite Corp.**, Kenton, N.J.



For Aircraft Air Valving

New valve, designed specifically for use on transports to provide air flow as well as assist in air cell valve in cabin air conditioning system or wing and engine air-cooling system, is offered

New Thermal Switch

Weighting only 1.4 oz. and specially adjustable for temperature within -75 to 1250 °F., switch made by **Alpha Prod. Co.**, Union Pacific Ave., Los Angeles 23, Calif., is designed primarily for the detection of fire and can be used for cycling control of cabin heating system and ventilation or of cold refrigeration in aircraft. Feature is "freezeless" pivot to insure accurate



Custom-Made Wrenches

Special design wrenches in small quantities are offered by **Dayton-Rogers Mfg. Co.**, Minneapolis 7, Minn. Wrenches are particularly adaptable to special equipment where cut or some special wrenches are required to be shipped with each piece of apparatus. Wrenches may be precision-bored smallest size up to maximum length of 20 in. in gauge thickness of 1/8 to 1/4 in. Units can be produced from any sheet stock, least costed and finished to customer's own requirements, and are reported to cost considerably less than regular forged construction.

return to the aviation manufacturer and distributor, is checking parts and change desired by the customer represented by his group.

Al Vanderschot, Continental Motor Service manager, stated the importance of service facilities at engine distribution points, and discussed plans for a new system of warehouses for engine parts to serve distributors, which is a current experimental project for his company. **Magnus Quindred**—B. M. Durban, president of Durban Aircraft Service, Inc., Woodside, N. Y., described present margins obtained in distribution of aircraft engines, and recommended improvements in selling methods, particularly in distribution of engine maintenance, indicating a range from 15 to 25 percent while ADMA distributor members reported income of from 24.7 to 26.1 percent in the last two years. Distributors Durban believes, in many cases are now giving up on the high margins of profit from war surplus sales, but this is a temporary condition which soon must be improved by readjustment of other margins.

L. W. Tait, service manager of Beale Aviation's Scrubia Magna division, reviewed his organization's methods for establishing distributor qualifications.

H. Donald Richards, ADMA executive secretary, reported the association currently has 111 members including 74 members and 37 observers. The large membership is a history. It is believed that the distributor membership is close to a leveling off point during the current status of the industry, but that there will be a number of other contributions who will become members in the near future.

Beverly Howard, retiring NATA president, speaking before ADMA, reported that the local bus operator has done no selling since 1949 and that he is out of the business. He signed the importance of selling flying in general and selling safety as opposed to better competitive products selling and attacking the consumer's product.

Gil Quander of RCA radio chairman for ADMA, reported that 20,000 planes are now equipped with radios and predicted a similar service to radio navigation on planes with use of VHF radio equipment and the transmitters.

New Encourages

Two new 1949 models of the Implant Enclosed are being presented for announcement and first demonstration dispensing. One is made of aluminum and the other of magnesium. The two models are designed for the two-sectional quippan plane manufactured by Engineering & Research Corp., a continuing activity on the forthcoming models.

—ALEXANDER McSURELY

BRIEFING FOR DEALERS & DISTRIBUTORS

COURT BIGHT STAYS—Alleging that Veterans Administration Carl Goss has "shoved his discharge" in applying on "unmerited benefits of proof," Juan Esteban, drawing to take vocational flight training, a man he has lived in Federal court in the District of Columbia, has filed suit against the VA as defendant. Goss, H. V. Strohberg and E. W. Kelley, assistant administrators, and A. H. Menz, training facilities director, Plaintiff; W. G. Moosman, Jr., of Portmouth, Va., a veteran who is a commercial photographer and seeks flight training in order to become an aerial photographer.

Suit is based on American Veterans of World War II. It asks that the court require VA to accept "the bona fide discharge statement of the applicant that he will give the training in his household" as sufficient evidence without requiring the exhaustive inquiries now being made by VA into the intent of veterans flight training applicants, and the "mostplete justification" now demanded.

(Typical of the justification now being asked is a statement from the Miami Regional VA office: "A veteran will have submitted complete justification when he submits such facts and evidence as to make it reasonably impossible to conclude that the course of flight training is not connected with his present or contemplated business or occupation." If no facts or elements to show the connection between the flight course and the present or contemplated business or occupation are found, then the justification fails short.)

\$1,000,000 IN SALES—George Haddaway, the well-known aviation entrepreneur from Texas, calls to attention the outstanding record of J. D. Reed Company, Beach distributor at Houston. Since the first of the year Reed's Beach sales have totaled over \$1,000,000 which is an excellent record in my view, but particularly good in 1949 and tops among Beach distribution in the nation.

In addition to the main operation at Houston, the company has facilities on Love Field in Dallas, and at New Orleans Airport. Reed is now starting to build a new \$350,000 hangar at Houston which will accommodate two rows of multi-engine planes with space for four-place Beach Beacons between the larger planes.

NATE CHANGES MIND—Navy decision set to institute Ops Lock airport outside Miami, Fla., means that commercial operators who have been making their plans to pick up and get out will be able to stay at the large field. Particulars pleased are the operators of Tonky Ridge International School of Aviation, one of the largest aviation training operations in the South, and Imperial operations on Ops Lock field.

AGRICULTURAL USES MEETING—Further development of the National Flying Farmers Association's program to establish a confidential national research program for the airplane application of pesticides, fungicides, and herbicides and its annual meeting is expected at a conference to be held in Chicago, Nov. 30. Participating will be federal and state government officials, commercial dealers, agricultural college representatives, chemical manufacturers and aircraft manufacturers.

REORGANIZATION OF NATIONAL FLIGHT—Revised plan to stimulate flight training which involves a campaign to sell 1000 flight training operations nationwide has been announced by National Flight Systems, Inc., which is doing considerable advertising.

Under the new plan, NFS will provide a sales promotion staff including five regional directors, 40 district managers and 120 area supervisors, who will work with sales representatives of the individual organizations in concluding a new sales market of persons who have not heretofore been interested in flying. Robert Pike, vice president and director, said in a Washington news conference that under the plan the student could buy a flight membership under financing plans for as low as \$12.5 a month plus, as heretofore, sells eight hours of flying or enough to solo, plus a one-month home study ground school course, together with a discount arrangement making it possible to buy enough flight time for a private pilot's license. Total cost, including membership, is around \$300 as compared to about \$400 which Pike says is average cost of getting private pilot's license as usual manner.

By August 31st, 1948

The **MAMBA** had completed

5000 hours development running

500 hours endurance test

150 hours civil and military type test

100 hours flying



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Right now—in the engineering department of the Boeing Airplane Company in Seattle, Washington—are openings for graduate (or the equivalent) aeronautical, mechanical, electrical, and civil engineers. For aero-mechanics designers and analysts there are unusual opportunities.

At Boeing your engineering skill and imagination will be applied to the most advanced military and commercial types of aircraft. The work involves all phases of aircraft design, from the detailing of small parts to the layout of major components, stress analysis, weight control, vibration and flutter analysis, research, development, and all associated engineering required for completion of the design of the final product.

There's a future for you at Boeing where the current backlog of business totals more than \$400,000,000. Outstanding engineering research facilities are available to you. Your associates will be the men who have contributed to Boeing's reputation for leadership in aviation research, design and engineering.

To all these advantages that Boeing offers you, add the fact that living is pleasant in the Pacific Northwest. No extremes of heat and cold. A wide variety of recreation is available the year round—fresh and salt water sailing and fishing, boating, golf, and mountain climbing.

Similar openings are available in the Boeing-Wichita, Kansas plant. Inquiries indicating a preference for Wichita assignments will be referred to the Wichita Division.

For an interested brotherhood, "An Evening With," on Boeing engineering, and additional information on the opportunities discussed here, write Personnel Officer, Engineering Division, Boeing Airplane Company, 7777 E. Marginal Way, Seattle 46, Washington.



ANSWERING YOUR QUESTIONS

1. **What about housing?** Recent news employers have no difficulty. Our Personnel Dept will give you all possible assistance in finding suitable housing.
2. **What are opportunities for advancement?** Opportunities in all engineering fields are actually unlimited and depend primarily on training, ability and application of the individual.
3. **Does Boeing need men with advanced training?** Definitely. Men with advanced training and degrees are very much in demand and command correspondingly higher starting wages.
4. **What are the working hours?** Normally an eight-hour day and five-day week—\$60 to \$75 daily.
5. **Is there a formal school or training program? New engineers are normally placed in a group commensurate with their qualifications. A short training program carried out consecutively with design assignments is given for familiarization with Boeing procedures and practices.**

ADDED ADVANTAGES OF WORKING AT BOEING

1. Two weeks vacation with pay.
2. Ten days sick leave per year—no necessary.
3. Low cost group medical plan.
4. Excellent accident and health insurance.
5. Unusually generous group life insurance.

For the Air Force, Boeing is building the B-52 bomber, B-47 jet bomber and C-97 transports; for the Army, the U-16 liaison planes;

and for six major airlines, the multi-deck Boeing Stratocruiser.

BOEING

AVIATION WEEK, November 29, 1948

AIR TRANSPORT

P.R. Nonskeds Challenged on Safety

CAB hears complaint that travel agents cut carriers' returns so low that maintenance suffers.

Instead of unassisted airplane operators that low-cost transportation and air safety can go hand in hand in being seriously challenged.

Clothes of criticism are enveloping the heating operations being conducted by regular lines between New York and Puerto Rico. The situation has already stirred Federal action.

Transoceanic operators, fearing they may be hurt by retaliatory actions against the Puerto Rican nonskeds, consider their heating largely depends upon traffic generated by travel agents, use New York travel agents handling most of the Puerto Rican business. They have endorsed the resolution of the Civil Aviation Act by calling on state legislatures to direct their state governments to prohibit the Civil Aviation Board, and, in support, U.S. attorney has made the following charge: that the enforcement of some ticket agencies on the Puerto Rican bases have suffered revenue to such a point that maintenance has suffered and safety is endangered.

► Call for "Police." Possibly with this situation in mind, R. B. Hart, president of the Non-Certified Air Carriers Assn., has called for a program of "internal patrols" of coach-class ticket agencies by the carriers. Hart, who also is president of Viking Airlines, said: "We have recommended to Congress that it appropriate for the Civil Aviation Board to make such a program. He said: "The board has come to us to establish order within our industry and to make the public aware that low cost air transportation does not apply indirectly to safety and reliability."

Following the recent financial difficulties of several air mail agencies in New York which offered \$85 transoceanic tickets, Hart and Ira in a point below which it is commonly assumed to reduce air passenger fares. "Passengers who pay cash for transoceanic air mail flight have assumed that the agency taking their money will use it to finance an expense to deliver the following day," Viking and other western coast nonskeds have been charging \$99 one way.

► Dependent on Travel Agents—Hart said that most nonskeds are almost en-

tirely dependent on travel agencies for business, it is part of the carrier's responsibility to guarantee the reliability of the agencies to the traveling public. Accordingly, Hart continued, the Non-Certified Air Carriers Association will accept applications for approval from agencies handling coach fare sales and carriers that respond to determine their financial responsibility. Approved agencies will be given use of a seal which may be displayed at their offices and used in their advertising.

The Association's action followed an incident in which 61 passengers purchased \$60 transoceanic tickets from a New York agency, which promptly vanished. Unassisted carriers came to the passengers' rescue, hauling them west, and the police dragged an investigation.

► No Letup Soon—But CAB's investigations of skyhigh nonskeds and belief agencies serving them show no sign of letup. Board investigations have been late in Los Angeles, San Francisco and Seattle gathering data on transoceanic and Pacific Northwest Alaska service. Public hearings may be held and more redactions sought.

It was a mixed New York CAB house-



AERIAL PILGRIMAGE

Living in the air. Picture shows the last of 80 Arabs who recently left Tunis for Mecca via TWA. These women wear in the group, one of whom is 86 years old.

AVIATION WEEK, November 29, 1948

TRANSPORT

31

booked for a specific airline, the ticket agency may be entirely ignorant of that carrier's legal tariff. And the carrier frequently does not know (and may not want to know) what the agency charged the passenger.

Commissioners are not at a loss, however, in the spring of 1945, because CAB has issued the regulations. Just as in fact, both the agent and the carrier will be held to task, but they are still held. A frequent practice is for an agent to assemble a group of passengers going to Puerto Rico on a specific day. The various schedules being on the plane to which the business, let the agents hold on to their passengers until the weather has quota the lowest price. To be sure, the passengers aren't left stranded, as agents are, without part of their payment to the carrier until the flight is completed.

Agents are sometimes confused by the number of different carriers offering business that they don't know who owns the planes providing the transportation. Some airports have been operated under more than one name at the same time.

► **Equipment Required** — One travel agent said he made a practice to go out to the airport with his passengers to look over the planes they would use to make sure coffee and telephone equipment was aboard. He asserted that he had taken passengers off one plane because there weren't enough seats in the rear and people were standing up when the craft was ready for takeoff. On two other occasions (involving different lines) the planes were not sufficiently clean, and in still another case the agent refused to let his passengers fly on a ship with headgear and seat belts.

"Once I went to the airport early and saw the maintenance workers on the day I was to fly my customers. The mechanics told the pilot he could not be the plane until the headgear and the pilot insisted on leaving, so I took the passengers off."

The carriers are usually well acquainted with each other's operations and on occasion there are conflicting requirements to the care of less-than-plane-load groups of passengers. One ticket agent said flatly: "Invariably we are between the personnel of the carriers in the fierce competition for passengers."

► **Fight At Airport** — He described a recent battle at Teterboro, N. J., between the agent and pilot of one operator and the agent and pilot of another carrier. "Pretty hellish fight back there," he declared. More often, however, one carrier agrees to take in other company's passengers one day, and the exchange is reversed the following day.

Some agents choose planes They

choose different carriers, and whether often the cheapest rate gets the business. A DC-3 with perhaps \$1500 or \$1600 a roundtrip from Teterboro to Puerto Rico, regardless of the number of passengers carried. When the ticket is deposited, the fare is also listed, then the agent may find he has insufficient passengers and may lose money on the deal. He may then start calling other agents and carriers, hopefully offering passage at almost any price.

► **Advertisements Misleading** — Advertisements of some travel agents are more "salesmen", one agent advertised New York-Puerto Rico tickets may be advertised for \$28, but when the promoter enters the office he is told the price is \$28 for transportation, plus \$5 or \$10 for insurance, and \$2 or \$3 for food aboard the plane.

A passenger may pay up to \$112 for his ticket. When asked how much, he may find the fare is included but paid with \$40, \$28, and \$10 for the same arrangement. "There are no planes as clean as ours," flight, CAB spokesman was told.

"From our own personal experience I realize that a manager can't make money from passengers. If the Puerto Rico is \$27 or \$30 each," one ticket agent declared. "I know the rate will come down when there will be plane crowds."

Challenger Certificate Extended into 1950

The Radio Mountain area from Denver and Salt Lake City north to Billings, Mont., has been around of federal acreage for another 12 months as the result of a CAB decision granting Challenger Airlines a new route certificate extension. In permitting Challenger to stay in business at least through May 30, 1949, CAB cited the carrier's operating costs, which showed continued improvement. The company's first year of operations was ended in March, 1948, and would have expanded and May 30 had the extension not been granted. Late last summer (American Wire Sept. 11), CAB refused to extend Florida Airways' certificate beyond March 28, 1949, stating that the feeder's operating results did not suffice the air mail subsidies account to support the carrier's services.

► **Year's Record** — During the year ended Aug. 31, 1948, Challenger carried 95,795 revenue passengers and flew 4,988,000 revenue passenger miles, 27,050 total ton miles, and 97,024 cargo ton miles. Passenger loads on the carrier's DC-3 varied from 123 in a service made in February, 1948, to about 60 in June, 1948, with an average load of 392 for the 12-month period ended Aug. 31.

From May 3, 1947, when operations began, until Aug. 31, Challenger reported annual revenues of \$344,279, or \$27,670 per month, and net revenues of \$317,861, or \$26,483 cents a mile, expenses of \$1,353,532, or \$89,901 cents a mile, and a resulting net operating loss of \$582,912.

For the year ending Aug. 31, 1948, Challenger expects to boast its annual revenues to \$391,762, or 40.46 cents a mile, while road revenue will be about \$877,544, or 60 cents a mile, and expenses \$1,371,463, or 93.77 cents a mile, leaving \$97,385 net income. The company hopes to sustain its average passenger load to 6.55 per revenue mile, partly through installation of additional passenger seats which will improve service dependability.

Challenger's balance sheet on Aug. 31, 1948, showed a net worth of \$226,982. The company is in the process of raising funds, which of fully subscribed, will total about \$640,000 to liquidate current obligations, provide additional working capital and enhance its financial position.

Post Office to Wait On Parcel Post Changes

Post Office Department is taking a "wait and see" attitude on proposals that air mail post rates be lowered in stations where they exceed regular postal rates.

This new occurs on low-weight shipments, particularly on long hauls. It results mainly from the fact that the 5-cent-a-ounce regular mail rate applies to the whole country, while the air mail post act sets up graduated rates for the eight postal zones. Under these rates an eight-ounce air mail post shipped from New York costs 45 cents to Philadelphia, 75 cents to St. Louis, 95 cents to Chicago, 95 cents to Salt Lake City or Denver, 100 cents to San Francisco. Regular airmail rates on the shipment would be only 90 cents.

The Postmaster General has sweeping authority to change air mail post rates and regulations. Deputy assistant Postmaster General George Barnes and the Department is considering a regulation under which air mail post rates in any category would meet the regular airmail rate if the Department will postpone action until it has had several months to work over the new service.

Only justified solution to the problem for the immediate future is for shippers to deposit packages in regular airmail when it is cheaper. This involves the additional trouble of classifying the categories in which air mail post rates are competitive.



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PIONEER EQUIPS GROUND STATIONS WITH
Wilcox Type 378A Package Radio

PACKAGE DESIGN SPILLS YOUR INSTALLATION

The Type 378A incorporates four complete packages in a cabinet ready for installation. It is designed for unenclosed VHF ground air communications at mobile traffic control.

PROVEN COMPONENTS INSURE QUALITY AND PERFORMANCE — The Type 378A VHF Receiver and Type 204A VHF Transmitter, both tested as the principal components of the 378A, long used separately and individually by leading airlines. These units are now available in package form.

NEW AIDS TO CONVENIENT OPERATION

The telephone handset with its convenient push button controls can be connected as required to either the receiver or transmitter and interphone, with an auxiliary jack provided for connecting other. The 378A includes dual local message rack and transmitter switch; these are an option otherwise not available.

LOCAL OR REMOTE CONTROL

It is desired the control panel can be removed and the 378A mounted elsewhere, if desired by re-mounting the panel in the operating position or by simple separation in part mounting remote equipment.

*Power-driven unit also 1000-watt equipped with the new WILCOX Type 381A. All-in-one VHF Communication System.



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Write today for complete information

Some short jettings for airline operators, charter companies and V.I.P.s

WHAT THE PRESS IS SAYING OF FLYING BOATS

Flying boat opens land route

Elephants move to let plane land

By RALF CARSTEN

JOHANNESBURG, South Africa

A long shot started in Johannesburg, West Rand, on Nov. 12, at 10:30 a.m., in a Cessna 172, piloted by Johnniesair—society's and its founder's personal transports service over a hundred miles through the heart of Africa.

Cessna 172s, which have already won 20 international trophies in air racing, proved no problem on takeoff and climb on the 4,150-foot trail road.

We were the first flying boat ever in "land" on the 100-mile 200-kilometer roads above the 10,000 Victoria Falls.

To make that possible, two herds of elephants had to be driven from their forested water-groves.

All mod. con.

The 31 passengers with us on the proving flight looked down from the inevitable places seeing herds of elephants, on the ecology of the type and their hippocampus, on the circadian aspects of elephant life.

Since the planes, answer of 200 miles we have over forests, woods, and wells, three were setup.

Approved by permission of the Daily Express



Others, hot and cold winds, + Monsoon, and the same climate awaited here. But the weather was favorable. Because the answer from those experts made it unnecessary to leave early again.

"Give us flying boats every time" they say

From Johannesburg to Asuncion (Bolivia) for the first radio and television in Paraguay and Uruguay, the second stop is made, where passengers have no opportunity to visit the attractions.

From Lusaka the flying boat will cross the Indian Ocean to Pago Pago, on the north coast of Little Samoa, the southern right.

Then comes a 6,000-kilometer journey northwards across Lake Victoria, Malawi and Southern Rhodesia to the next stopping place and night stopover in Victoria Falls, the Victoria Falls. The last stop of the round-the-world venture Southern Rhodesia to Vicksburg, the Johannesburg terminus.

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NEWS CHRONICLE

New Worlds

THE possibility of world touring by airplane opened up attractive possibilities for British travel agencies. The travel agent has been, up to date, the escort of the man who was bent—single-mindedly and a trifle grimly—upon reaching his destination. The picture changes with the arrival of the tour. But to most of us, more relaxed or less intent, travel remains quite as important as to anyone.

For people who are not so inclined to travel with greater caution and the more leisurely schedule which allows something more than a week-end, there are now some alternatives while the land plane cannot offer.

BAC A.C. is well equipped to turn these attractions into a reality. In Europe, particularly in Britain we have seen experience that our other major in operating transatlantic flights. This has been repeated in South Africa, we have proved that the public, wanting to have these attractions, can travel across the world. A very promising luxury transatlantic trade can be seen for the future.

We can only say it is believe, when that can be done without disrupting our services to the rest of the world. Although our flying boats have been designed to carry out as many as 100 passengers, we have found that 50 is a better load factor and places. We cannot take on new commitments until 10 A.M. on Dec. 1, 1948, with a fleet of 10 aircraft which will enable them to meet all contingencies on the normal air routes of the world.

The new design of the flying-boats, then, are now being studied as to what way efforts should be applied to make us, by far, the most comfortable and great aircraft of divided civil aviation which has been promised for so long, but which is as yet fully delayed in the achievement.

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Two Airline Officials See Brighter Future

Top airline executives are taking a brighter view of the industry's future in their public statements.

Ralph S. Dawson, American Airlines president, told the Oklahoma City Chamber of Commerce recently that the carriers will soon begin to show profits "provided economic conditions do not change adversely." And Warren L. Frans, TWA board chairman, but soon firmly ready for the much-cited annual Civil Aeronautics Board hearing on company management meeting in Kansas City.

► **CAB Flying Responsibilities.** Frans denied that a resolution of the Civil Aeronautics Board to allow long-haul flights to the industry's savings might and in accepting its responsibility for the encouragement and development of U.S. commercial aviation. He said the CAB has refrained a bad situation which developed at a time when the Board was unresponsive, over-worked, and apparently related to fare size and route problems as radically as required by the collapse of an transport's war bonds.

But TWA's chief executive also wanted his superiors personnel that a large part of the responsibility for failure of the airline's difficulties could be shouldered by company employees. "The Civil Aeronautics Board requires CAB to help the Lord, to help only those who help themselves," he said.

► **American Costs Cut.** Dawson, an experienced airline executive, noted that company's success in cutting costs while building up efficiency. He said American's low-fare load factor has been coming down steadily.

After increasing fairly constantly at around 55 percent through 1943, spiraling costs blotted the break-even point to a peak of 62 percent in 1946. Even that almost impossible figure Dawson explained, American had the break-even load factor down to the low 60s by midsummer 1947, but the DC-4 aircraft gradually drove it up again to 65 percent.

With the return of DC-3s in service last spring and the start of Convair Liner operations in June, American's break-even point dropped to 55.4 percent in September. By next summer, American hopes to have the load-factor down to 50 percent.

► **DC-3s Too Expensive.** Dawson declared flatly that the relatively slow DC-3s have become prohibitively expensive to operate. He said that in a year the DC-3 put an average during 1945 an average aircraft was the safety of its mission. By early next year American expects to have all its DC-3s and DC-4s in passenger service replaced by DC-6s to Convair.

Large postwar capital outlays for new equipment would get justified, Dawson added. He said the cost of buying DC-3s rose to \$5 cents a seat-mile last summer, while the seat-mile cost on DC-6s was only about \$2.75 cents and on Convair 70 cents.

The American Airlines president planned that the airlines are faced with a contracting travel market, but even so are getting a larger share of the total business. Overall, airfares have dropped from 115 billion passenger miles in 1945 to 88 billion in 1946 and 67 billion last year. Estimates for 1948 overall industry traffic is 61 billion passenger miles.

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American's efficiency program cut the number of employees from 30,000 available to 20,000 miles from 7.95 to 5.95 to 5.65 in 1947. During the first nine months of 1948, the figure was further reduced to 50,000, and in September alone American had only 4,470 employees per 10,000 available miles.

Two Carriers Plan Trans-Pacific Service

Starting just ahead of Northwest Airlines' nonstop service, Pan American Airways planned to inaugurate the first direct scheduled flight between the Pacific Northwest and Hawaii during last week.

Pan FAA trip was to leave Seattle and Portland on Nov. 24 for Shanghai, via Honolulu and Tokyo. Thereafter, FAA's trans-Pacific flights from the Pacific Northwest will depart on Wednesdays and Sundays. A third weekly trip is slated to be started by Pan American next March.

Northwest Airlines' trans-Pacific flights from Seattle and Portland to Honolulu are to begin Dec. 2 (Aviation Week, Nov. 5). Both carriers will use DC-4s on the route at the outset and will charge \$350 one-way or \$575 roundtrip—the same fare offered on the Los Angeles and San Francisco to Hawaii links.

Pan American Airways has selected CAB for \$1.65 cents a plane-mile fare policy will pay for its trans-Pacific route.

Northwest previously had asked the CAB for the same rate of temporary mail pay on its trans-Pacific route.



VEALERS FLY EAST

Upper midwest Bataan dealers are taking advantage of air freight to save time and avoid weight losses as moving out values into eastern markets went steadily liberalized. Particular shows the fast shipment of 54 vehicles as it was being loaded aboard a C-47 operated by Air Cargo Express, Inc., at Bataan Field, St. Paul. Seven hours later the entire unit was in the rail shop line of the

Milwaukee West and Western Co., Newell, N.J. Shippers report that the rates, listed at about 150 lb. per cubic, can be taken off at their destination at nearly the same weight. Load assessment to New Jersey would be the equivalent of six days, and they would lose weight despite freehold. Air Cargo Express, Inc., has three DC-3s and is charging about \$6 per 100 lb. to load the olive oil.

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EDITORIAL

Air Show Pays Off

AVIATION WEEK's editorial series, "Pending Millions to Fly," cited on Nov. 1 the air show held at Thessaloniki Greek airport at Hellenikon, R. 1, near Piraeus, to familiarize the public with commercial aviation.

Robert M. Howard, airport manager, reports an encouraging turnout.

"I want you to know how grateful we are for your generous comments in connection with the airport open house.... One of our principal reasons for holding the event was to get support for a three million dollar bond

vote for airport development."

"I am glad to report that it was approved by a vote of better than 3 to 1, which is gratifying in view of the opposition to providing airport funds which has been encountered in some other places."

"I think the vote indicates we went about selling the airport in the right way."

"Put me down as a strong backer of your series of editorials on how to get people into the air. If you hear of anyone I can help in staging similar events, tell them to get in touch with me!"

Hillercopter—Daring Enterprise

Licensing of United Helicopters' "Hiller 360" utility helicopter may stimulate new interest among major aircraft manufacturers and aviation financees in the rotary wing industry.

The former will be inclined to watch closely the results of United Helicopters going into production with a major shareholder Stanley Hiller, Jr., says he will sell at under \$25,000—approximately half the price of a comparable machine.

Two things will prompt financiers to take a new look at the helicopter industry. One is the "360" price tag. The other is realization that the comparatively low pricing comes without benefit of engineering and development costs having been written off by Government orders. The venture capital of some 3000 stockholders financed United Helicopters, and production initially is for commercial markets and without support of a Government contract subsidy.

Manufacturers and financial agencies alike will be giving United Helicopters, Inc., attention study to observe first, buyer reaction to the offering of a relatively low cost product; and second, UHI's ability to realize profits and write off development costs at such a price.

If UHI shows a profit, financiers will be encouraged to sponsor new aircraft enterprises on the evidence that they offer development costs much lower than those attending a major aircraft company's designing and production of a new aircraft.

Surely, the success of the United Helicopters venture will prompt major aircraft companies to consider anew the idea of looking to small subsidiary companies, now comprised, by having to share big company operating costs for new production items. Too, they will be prompted to invest in small companies having potential, good products that can be acquired when development reaches a point where risks and prices can be forecast.

These are not new observations, but they are given

new meaning by the fact that at Palo Alto, Calif., a helicopter company is going into production of a licensed machine priced at a level many may consider to be logically low.

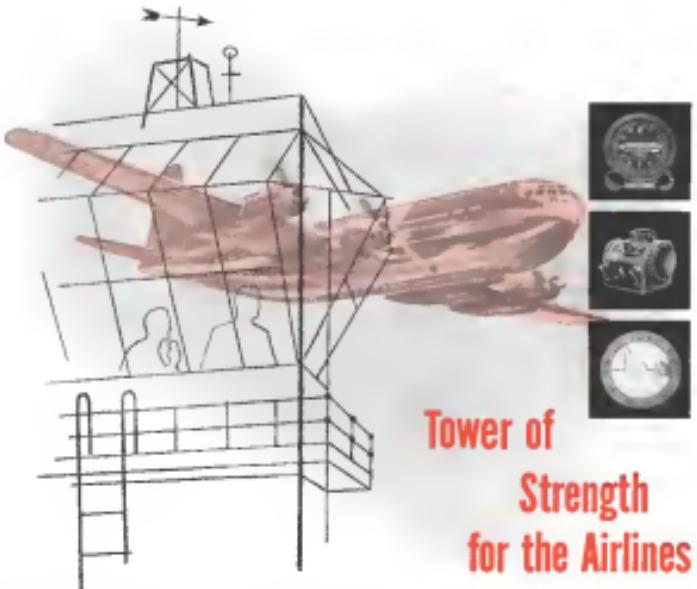
It is interesting to note that in the instance of United Helicopters, three major aerospace plants showed active interest in acquiring Mr. Hiller's venture, and that east coast capitalists turned him down cold when he tried to obtain money, at the age of 21, to start his company after successfully flying his first experimental machine. Since then he has raised a little over \$2 million in two California stock issues to see his UHI over the hump of development, certification, and rental production.

Aircraft manufacturers who originally approached Hiller failed to complete deals for various reasons. While one eastern company won red tape negotiations labored only through corporate executive committees, Hiller was won over by Henry J. Kaiser's associates that lasted only a year. One west coast plane builder, known to have a helicopter for its personal aircraft stockpile, made a cash proposal, but terms were not to Hiller's liking. Another western company, one of the large, wanted to take over United Helicopters, but lacked liquid capital to clinch a deal.

It is not to imply that financiers and manufacturers have been short-sighted in their viewing of the helicopter. Their very existence dictated caution. Seldom are they justified in investing large amounts of capital without the support of successful precedent.

But, it seems quite possible that if a record of success is written on the books of United Helicopters during the coming year a powerful "precedent" will have been provided to justify strong financial and manufacturing advancement of the rotary wing industry, and lift this industry out of dependence upon military orders and high prices which stifle commercial markets.

ROBERT H. WOOD



Tower of Strength for the Airlines

Top: The strength of the numerous airlines has in large measure to provide passengers with safe, pleasant and reliable air transportation. Helping the carriers in this are the C. A. T. Traffic Control Towers on hundreds of airports across the country.

Top: Sperry's control of all air traffic and one of a field is unusual, particularly when large numbers of airlines are involved. Carrier Traffic Concentration with all incoming flights given orderly and systematic arrivals and departures with due sense of drama.

Top: To speed and simplify landings in all kinds of weather, Sperry has available the most modern flight equipment—the A-1E Gyroflex® and its accessory, Automatic Ap-

proach Control. Using signals from the Localizer and Glide Path of an Instrument Landing System, Automatic Approach Control, operating through the A-1E Gyroflex, guides the airplane along the path defined by the lights to within 40 feet of the runway, where the human pilot takes over.

Top: In addition to many of the airline needs are other Sperry avionics products—the Gyrostar® Compass and other flight instruments giving accurate information in position and direction. —The Engine

Analysts that detect, locate and identify engine malfunctions during flight, saving valuable time on the ground.

Top: All Sperry's products have been designed, light-weighted and ruggedized to deliver the best possible flight performance at the least cost of maintenance. They are products of Sperry's engineering research—a continuous program that seeks improvements in old products, the development of new products, all for the advancement of modern aviation.

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"Does Bonanza travel pay?

It triples my business!"

... reports Robert Yarnall Richie, industrial photographer


"In my 4-place Bonanza the other day, my assistants and I flew the 250 miles from Tulsa to Madill in 1½ hours. Between 2 p.m. and sunset I completed a big oil refinery photographing job. Next morning we loaded my 500 pounds of equipment and hopped to Longview, 225 miles away, for an equally big job there.

"The net result was completion of two jobs in two days, plus several contacts for future business. Gas and oil cost \$12.85. Two comfortable, restful hour-and-a-half flights instead of two days of hard driving on the road. Many of my clients are off regularly scheduled routes, and public transportation would not serve us.

"I know of a manufacturer in Los Angeles, a doctor in New York, and an engineer in Texas who, with their Bonanzas, have tripled the area they can see to personally—and at great personal profit. The Bonanza certainly is a revolutionary new kind of business machine."

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